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MEMORY

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PSYCHOLOGY TEACHERS UPDATE

Psychology Teachers Update is designed to give a brief overview of the main developments in the different areas of psychology. There is a proliferation of journals and research, and it is very difficult to keep abreast of the latest trends, particularly in the many and varied areas of psychology.

Each issue of Psychology Teachers Update will cover a particular topic, and summarise the main research directions and findings in the last ten to fifteen years approximately. The aim is to give teachers the feel of what is happening in that area of psychology.

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Introduction

The dominance of the experimental approach in this area of psychology still continues, and there are many studies looking at the favourites, like short-term memory, still. But the main directions in recent years have moved away from the controlled lab experiments.

The main areas of development and sections for this issue of Psychology Teachers Update are:

i) Cognitive neuropsychology - work with individuals with brain injury; sometimes called atypical cognitive functioning or studies of cognitive impairment or amnesiacs.

ii) Autobiographical memory.

iii) Collective remembering and the social construction of memories.

The last two topics are part of the move to study "everyday memory". Researchers in this area disagree with the traditional experimental cognitive psychologist on what aspects of memory should be studied; how they should be studied; and where the studying should take place (Koriat and Goldsmith 1996).

There are many other developments in recent years, and Eysenck and Keane (2000) is a good starting point. Table 1 lists a number of these developments.

- Cognitive science: computational modelling, like connectionist models
- Cognitive neuroscience: use of technology, like brain scanning, and work with animal models (Kandel and Squire 2000 summarise the main history)
- Extensions to Working Memory System
- Changes to Level of Processing Model (Lockhart and Craik 1990)
- Search of Associative Memory (SAM) Model (Raaijmakers and Shiffrin 1981)
- Multiple-routes of recall: direct and indirect (Jones 1982)
- Transfer-appropriate processing (Roediger 1990)

Table 1 - Main developments in memory research in recent years.

Cognitive Neuropsychology

McCarthy and Warrington (1990) define cognitive neuropsychology as the "analysis of those handicaps in human cognitive functioning which result from brain injury" (p1). While, for Ellis and Young (1988), there are two aims of cognitive neuropsychology:

a) "to explain the patterns of impaired and intact cognitive performance seen in brain-injury patients in terms of damage to one or more of the components of a theory or model of normal cognitive functioning";

b) and "to draw conclusions about normal intact cognitive processes from the patterns of impaired and intact capabilities seen in brain-injury patients" (p4).

There are a number of assumptions underlying cognitive neuropsychology (Eysenck and Keane 2000):

i) modularity - mental life is made possible by modules in the brain, which each perform one function only (eg: face recognition module);

ii) isomorphism - a correspondence between the organisation of the mind and the organisation of the brain;

iii) transparency - pathological performance provides evidence of which module is damaged;

iv) patients can be categorised into syndromes based on co-occurring sets of symptoms (eg "amnesic syndrome").

Cognitive neuropsychology combines studies of impairment with other sources of information, usually from typical cognitive functioning ⁽¹⁾. Cabeza and Nyberg (1997) summarise the findings from PET studies on normal cognitive functioning individuals as the basis for comparison with impaired cognitive functioning (table 2).

STUDIES OF IMPAIRMENT/AMNESIACS

Individuals who have suffered damage or injury to part of the brain have been studied in cognitive psychology on a small scale ⁽²⁾, but it is only in recent years has this area developed. It is hoped that case studies of atypical cognitive functioning will throw light on typical memory processes, mechanisms, and structures. For example, with the phenomena of double dissociation. Two patients showing opposite patterns of impairment known to have different brain impairments will

MEMORY PROCESS	BRAIN AREAS INVOLVED
Working memory system	
- phonological loop	Frontal cortex; parietal cortex
- visuo-spatial scratch pad	Frontal cortex; parietal cortex; anterior cingulate
Semantic memory encoding/ retrieval	Anterior cingulate; left frontal cortex; left temporal cortex
Episodic memory encoding	Anterior cingulate; left frontal cortex; left temporal cortex
retrieval	
- verbal info	Anterior cingulate; right frontal cortex; parietal cortex; cerebellum
- non-verbal info	Anterior and posterior cingulate; right frontal cortex; right parietal cortex; occipital cortex; cerebellum

(Data from Table 9 Cabeza and Nyberg 1997)

Table 2 - Main brain areas involved in memory processes from PET studies with normal cognitive functioning participants.

help in attempts to isolate areas of the brain and their functions.

AMNESIA

Amnesia can be caused by a whole series of factors, but the main ones are stroke or infarction, closed head injury, or chronic alcohol abuse (known as Korsakoff's syndrome). Other causes include: as a result of infection (like herpes simplex encephalitis), anoxia (lack of oxygen), sclerosis (hardening of the tissue), or through psychosurgery, to control epilepsy, for example.

Eysenck and Keane (2000) report the existence of "amnesic syndrome"; ie: common features of amnesiacs, which is mainly due to damage to the diencephalon and medial temporal lobes:

i) Problems in learning new material (anterograde amnesia).

ii) Difficulty in recall of events prior to amnesia (retrograde amnesia), and is most pronounced in Korsakoff's syndrome. For example, "PS" (bilateral thalamic infarction) (McCarthy and Hodges 1995) believed

still in the Navy (though many years since left), and had lost most of the autobiographical memories. "PS" also had problems with the retention of new information.

iii) Limited impairment of short-term memory.

iv) Some ability to learn new abilities after onset of amnesia.

EXAMPLES OF CASE STUDIES

The main contribution of cognitive neuropsychology is to establish that different aspects of memory exist in different parts of the brain. Thus "...memory is not a unitary faculty of the mind but is composed of multiple systems that have different logic and neuroanatomy" (Kandel and Squire 2000 p1118).

Here follows a brief summary of some interesting findings from the case studies of those with impaired cognitive functioning.

Short-term memory

Research over a number of years has shown that short-term memory is affected by the type of presentation of information, and the type of information itself. "K.F" (left inferior parietal lobe damage) has been studied extensively by Warrington and Shallice (eg: 1969; 1972).

a) Type of presentation of information: auditory or visual. "KF" had few problems with recall of three items presented visually (approximately 70% correct), but struggled when auditory information presentation was used (approximately 20% correct).

b) Type of information to remember: numbers or letters. "KF" found difficulty recalling three letters given by auditory presentation (26 of 60 recalled correctly), and numbers to some degree (37 correct). When presented visually, few problems for both types of information (48 correct in both cases) (reported in McCarthy and Warrington 1990).

Episodic and semantic memory

In rare cases, children are born with specific brain damage of which the effects can be isolated. Vargha-Khadem et al (1997) report three case studies of individuals with hippocampus damage, while the rest of the temporal cortex is unaffected (3).

These individuals have few problems in acquiring,

maintaining and retrieving knowledge (semantic memory), but could not remember personal events and episodes in their lives (episodic memory).

The double dissociation can be seen with cases of individuals who have damage to the temporal cortex, but not the hippocampus (eg: Bozeat et al 2000). They have problems with semantic memory, but can recall personal experiences etc.

Implicit and explicit memory

There is evidence of recall by individuals with cognitive functioning impairments at an implicit or "unconscious" level. In other words, the individuals remember or recognise information correctly, and do not know why. For example, participants are given a list of words to remember, and later asked to use word stems as cues (explicit memory) or finish word stems with first word that comes to mind (implicit memory). In the latter case, words from the original list are used. In some cases, amnesiacs do as well, if not better than the controls (eg: Graf, Squire and Mandler 1984).

While Gabrieli et al (1995) report work with "MS" (right occipital lobe lesion) who had normal levels of performance on explicit memory tests and problems with implicit memory tasks.

The nature of the task is important: amnesiacs show few impairments on implicit memory tasks; eg: conceptual priming with word association generation task. After a list of words is shown, the participants are given words and asked for an association. Usually a word from the previous memory list is used, even when the individual cannot explicitly recall the previous list (Vaidya et al 1995).

Declarative and procedural memory

Declarative memory can be seen as "knowing about" (ie: it covers both episodic and semantic memory), and procedural memory is "knowing how" (ie: skills memory). Generally studies with amnesiacs show deficits in the former and rarely in the latter area. A commonly used task for skills learning is mirror tracing. The aim is to trace a figure or shape which is reflected in the mirror. Performance on this task improves with practice for controls and amnesiacs. Even when the latter group do not recall having done the task before. This has been found in the case of "HM" (Corkin 1968).

Retrieval

There is evidence of differences in the type of retrieval being based in different areas of the brain. "CB" (Parkin 1996), with frontal lobe lesion, scored the same as controls for recognition tasks, but was clearly impaired in recall tasks.

Reed et al (1997) have shown that increased study time can increase recognition among patients with lesions to the hippocampus ("A.B", "P.H", and "L.J"). Where presentation time of the stimuli were short, the patients performed poorly compared to the controls on the forced choice recognition tests. But when presentation time was longer, the amnesiacs were nearly as accurate as the controls.

Autobiographical Memory

This is memory from an individual's life, and are episodes and events rather than the facts and single pieces of information of traditional lab experiments. Most importantly, they are difficult to verify ⁽⁴⁾ and score in the traditional sense as the recalled event may be personal. However, experimental versions now compare recall of an event at two points in time. The first recall being the baseline for scoring the second recall.

Rubin and Kozin (1984) asked participants to describe their three clearest memories: 18% concerned accidents or injuries; followed in frequency by sports events, love affairs, and relating to animals (eg: death of a pet). Only 3% of the memories reported were national events.

Conway (1996), who has developed this area in the UK, points out that autobiographical memories can include:

a) spatiotemporal knowledge - memories including location and time period in which episode took place ie the memories are in a general context;

b) factual knowledge - use of personal milestones, like the first day at university; ie: memories in a personal context. Again this makes verification difficult, but for researchers here it is the process that matters more than the factual accuracy of the memories: "remembering is a form of purposeful action" (Neisser 1996).

Thus this approach to memory makes use of qualitative methods, and it is an example of their "introduction" to cognitive psychology ⁽⁵⁾.

For example, the diary method as used by Linton (1982, 1986) to study her own autobiographical memory. She recorded two personal events on a daily basis to include in a diary kept over six years. Every month, Linton randomly selected events and tried to recall the dates of those events. By the end of the study, there were over 5500 diary entries, and 11000 including the monthly testing. All entries were rated for importance, and emotionality, both at the time of writing and if selected for testing.

Linton estimates that she had forgotten about 30% of the events by the end of the study. However, the type of memory was important: 50% correct recall for pleasant memories, 30% for unpleasant, and 20% for neutral events. The findings show similarities to the lab studies on forgetting, and the classic work of Ebbinghaus, which has many parallels.

- a) Memory for the events faded at 5% a year.
- b) Similar events were lost much quicker; eg: committee meetings.
- c) Distinctive events stood out; eg: committee meetings where particular things happened.
- d) No relationship found between the importance and/or emotionality of the memory, and recall.
- e) Evidence of organisation by lifetime periods in some cases, but also by categories or themes.

In a similar vein, Wagenaar (1986) recorded 2400 personal events over six years. They were recorded as: what is the event; who involved; where took place; and when happened; and rated for saliency, emotional involvement, and pleasantness. 20% of the events were found to be difficult to retrieve, but no event was completely forgotten.

Unpleasant events instigated by the researcher were better recalled than unpleasant ones observed. The opposite was true for pleasant events (Wagenaar 1994). Generally pleasantness was linked to recall.

"FLASHBULB MEMORIES" (FBM)

These are very vivid personal memories, which can be shared by a group of individuals (eg: death of a famous person). Brown and Kulik (1977) coined the original term, "flashbulb memories", in their work on ten key events in US history, like the assassination of President Kennedy. In some cases, it is possible to check these memories for accuracy.

The key aspects of "flashbulb memories" are known as "reception event": where they were and who they were with when heard the news; what they were doing; who told them; how they felt about it; and what happened afterwards (Brace and Roth 2002).

More recently, Conway et al (1994) looked at the "flashbulb memories" for the resignation of Prime Minister, Margaret Thatcher (on 22 November 1990) among 215 UK and 154 non-UK participants, one year after the event. 86% of the former group were able to recall full details of the "reception event" compared to 29% for the non-UK participants. The key differences were the level of importance attached to the event, the emotional response, and prior involvement (eg: interest in politics).

Cohen et al (1994) used the same event and tested

participants for factual knowledge after ten days and eleven months. The young adult group of participants reproduced similar narratives on both occasions, while 60% of the older adult group produced an entirely different account at eleven months.

The issues of the debate on "flashbulb memories" are:

- whether these type of memories are unusually accurate;
- whether a special memory mechanism is involved;
- what factors are important in the formation of "flashbulb memories".

1. Accuracy of "flashbulb memories"

Anderson et al (2000) leading the response of experimental psychologists to autobiographical memory research point out that such research tends to assume that the same memory is recalled each time, and that memories remain stable over time.

Research tends to find that older adults retell the same story word for word for significant memories (Rabbitt 1988), and this may be due to an overgeneralisation and loss of detail (Cohen 1998).

Anderson et al (2000) applied experimental methodologies to studying autobiographically memories. 28 adults with a mean age of 72 years and the same number of young adults (mean age 28) were used in this research.

The participants were asked to write about a high-frequency recalled memory and a low-frequency one. Then two months later, they were asked unexpectedly to recall the two memories. The memory stability was significantly greater for the older adults group. However, for both groups, memory stability was quite low: 58% for older adults and 46% for the younger group.

In further experiments, the groups were asked to recall memories from one, five and ten years ago. Two new groups were used with mean ages of 72 and 37 years old. Again the stability of memories for the older group were greater for all three memory periods.

Furthermore, there was no evidence that factors like surprise, importance, emotionality, and frequency of rehearsal increased recall.

Other studies have found that accuracy of recall depends on a number of factors:

i) Time since event - the accuracy of dating an event decreased by a day a week; ie: after 10 weeks, 12 days off (Thompson 1982).

The accuracy of establishing time periods is worse

for traumatic events ie they are recalled as more recent. This is called "forward telescoping". The use of a key event, like a volcanic eruption nearby six months before the study to avoid this effect when questioning participants about being attacked (Loftus 1996).

ii) Type of event - pleasant events recalled more accurately (Thompson 1985).

iii) Event occurred to self or other - self reference effect: dates remembered more accurately for self-related events (Thompson et al 1996).

2. Special memory mechanism

Patients with damage to the temporal cortex, but not the hippocampus, can recall autobiographical memories lacking factual details (anomically), even where there is a general loss of factual information (Hodges and Graham 1998).

3. Factors in formation of "flashbulb memories"

In terms of emotionality and personal context, and recall, Mackavey et al (1991) have studied what they call "autobiographical consequential events" (ACE); ie: consequential life experiences that are felt to produce a lasting effect. The researchers looked at 49 famous psychologists (average age 70 years old at time of study), and their autobiographical writings. The study was a content analysis of these writings. It was found that:

a) ACEs are not single episodes usually (69% of the 250 ACEs were not single events);

b) ACEs are similar to "flashbulb memories" (eg: recall of the place, and the vividness of the memory);

c) ACEs predominantly came from early adulthood (nearly 50% of ACEs came from the age period 22-35 years old).

An example of the type of entry analysed comes from Gordon Allport talking about an event in his early years of research:

The whole experience was a turning point. Never since that time have I been troubled by rebukes or professional slights directed at my maverick interests (quoted in Mackavey et al 1991 p53).

The ACE had to establish a causal connection between the experience or event and the consequence to be included in the study. The prominence of other people in the memory was also important with ACEs.

While Wright et al (1998) found that with the resignation of Margaret Thatcher and the "Hillsborough Stadium disaster" (on 15th April 1989), the event that produced the clearer memories was not rated as more important or more emotional by the participants. The level of clarity varied for the two events (table 3).

APPROXIMATE % LEVEL OF CLARITY

	THATCHER RESIGNATION	HILLSBOROUGH
where when told	60	73
what doing when told	59	67
how told	84	91
who told them	57	68

(Data from Table 6 Wright et al 1998)

Table 3 - Approximate level of clarity of memories for two events.

RETENTION OF AUTOBIOGRAPHICAL MEMORIES

Though it is difficult to establish the accuracy of autobiographical memories, it is possible to show the pattern of recall across the lifespan. There is evidence of a "reminiscence bump"; ie: a period when disproportionately more memories are recalled: five to 30 years old usually. While there is evidence of infantile amnesia for memories before five years old.

A number of studies have found this phenomena with 50s and 70s year old participants (summary in Rubin et al 1986). More recently, Conway and Rubin (1993) collected around 1400 memories from 70 adults in their 70s. There were two peaks: most recent memories (ie: last ten years) made up 27% of the sample, and 15-25 year old period 16%. The least memories came from five years old or younger.

The "reminiscence bump" does not seem to be a product of more significant events in early life nor more often recounting the events as time passes (Conway 1996).

Autobiographical memories appear to be organised in three layers (Conway 1996):

i) lifetime periods - substantial periods of time with linking themes; eg: "when I lived at X". Linton (1986) calls these "extenditures", and Barsalou (1988)

"extended event time lines";

ii) general events - summary of repeated events and "first experience memories" (FEM);

iii) event-specific knowledge - memories relating to general events.

The organisation of autobiographical memory into hierarchies based around these three levels is questioned by Berntsen (1998).

The emphasis on personally meaningful experiences has developed in a number of directions: a person's memory for lyrics (Wallace and Rubin 1988), television shows (Squire and Fox 1980), and ordinary everyday happenings (Barclay and Wellman 1986), for example.

Collective Remembering

Social constructionism has developed as an important perspective, particularly in social psychology. Among its contributions has been to emphasise the social context and joint process of much behaviour. Memory is no different. "Real-life memory" is a collective process where individuals are using their recalled memories in a social context. It is far from the traditional experimental paradigm (eg: Brown-Peterson Technique).

Edwards and Middleton (1986) believe in the:

importance of studying remembering as a social activity governed by the settings in which it occurs, serving a potentially large set of personal and interpersonal functions in which the significance of past experiences for current purposes is generally of greater importance than accuracy and completeness..(p423)

Within social constructionism, memories are treated like other utterances (eg: expressions of opinion) as actions and are used to achieve certain things. To remember an event is to tell a story.

For example, "family memories" are narratives which emphasise the common family identity as they talk about holiday snapshots (Edwards and Potter 1992). But the memories are not fixed as correct or not (accurate/not accurate). They are negotiated. Collective remembering is a negotiation process, where there is no absolute truth of what did or did not happen.

Hirst and Manier (1996) collected memories of the same events from four members of the same family: individually, then together. The information recalled is affected by the social context, and the process of the construction of the joint memory. It was found that members of the family would take roles in the group remembering session: "narrator" (tells story), "mentor" (guides "narrator"), and "monitor" (assesses the accuracy of the telling). Within the family, the roles may be set (by power differentials, for example), though the "narrator" can be the person who is central to the story being told.

Edwards and Potter (1992) applied this approach to "Lawsongate" (November 1988). It centred around an unofficial briefing, Nigel Lawson as Chancellor of the Exchequer held, about reducing benefits to well-off pensioners, and the denied by Lawson. Rather than there being the truth, Edwards and Potter look at how Lawson and the journalists present at the briefing tried to establish their version of the truth.

This is further developed when Lawson resigned as Chancellor soon after. He constructed his resignation as a matter of honour because of the conflict with the Prime Minister's economic advisor, Alan Walters; while Thatcher saw it as a resignation for personal reasons which was baffling to her.

At a social level, collective remembering is part of the national identity (and history). As with all narratives and discourses, certain players have a greater influence (ie: the dominant power groups). Often the collective memory is to their benefit.

Nuttall and Coetzee (1998) look at the "re-writing" of collective memory in post-apartheid multi-racial South Africa. There are many cases historically of collective memories being reconstructed differently at different periods in a society's history. Social constructionists would be interested in the political issues in this process, which will not be developed here.

Fivush et al (1996) have shown how young children's memories are constructed by their parents. Studying parents and children reminiscing about shared events from 40-70 months old, the researchers focused on the narrative structure. The parents do most of the remembering in such situations, and involve the children as they learn to participate in this process of collective remembering.

Children not only learn to remember but also learn about the social interaction that is remembering. Again it is possible to see how alien these ideas are to the traditional experimental cognitive psychologist.

DISCURSIVE MODEL OF REMEMBERING

Edwards and Middleton (1986) carried out what is seen as the key study in this area now. They asked eight students to recall the film "E.T", which they had all recently seen at the cinema. The discussion was recorded and discourse analysis applied. From this analysis, three processes were highlighted:

i) framing and orientation - the establishment of criteria for the joint recall (framing), and how individuals locate themselves in the unfolding account (orientation);

ii) correspondence functions - putting the ideas into words (semantic function), and structuring the order of events (continuity function);

iii) validation function - how the joint account is agreed.

The emphasis throughout this work, and social constructionism generally, is away from memory as an individual process to a:

wider, distinctively social context of establishing a mutuality of understanding between people, a shared version of past experience communicated through language
(Edwards and Middleton 1986 p441).

Edwards, Potter and Middleton (1992) have tried to produce a more formal model for understanding collective remembering and the social construction of memories because, for them, information-processing approaches ignore the "indefinitely variable nature of description". Their model contains a number of key propositions, which are also central to discursive psychology generally:

- a) the explanatory basis of behaviour is not cognition but action (ie: what can be seen or heard, or more correctly, transcribed for discourse analysis);
- b) "remembering" is operationalised as "talk";
- c) individual versions (memories) are constructed as factual;
- d) how the rhetoric of these versions are designed to undermine alternatives;
- e) the existence of "dilemma of stake". If individuals have a "stake" in their actions, then, to some degree, the importance of the argument can be discounted as personal interest. So individuals work hard to distance themselves from the arguments. One way is to make it appear that they are simply repeating facts instead of their views; eg: "it is a well-known fact that.." to back up an argument.

The response by traditional cognitive psychologists is included in the "Psychologist", October 1992 (eg: Baddeley; Hitch; Hyman; Neisser; Robinson; Roediger and Wheeler).

Footnotes

1. Technically these other sources of information may be classed as cognitive neuroscience.
2. "HM" (Milner 1959) removal of hippocampus to control epilepsy or "Clive Wearing" (Blakemore 1988) brain infection.
3. One of these cases appears in the BBC series "Brain Story: Growing in Mind" (2000).
4. Merckelbach et al (1997) argue that autobiographical memories are "intrinsically unreliable". They found only 80% accuracy in recognition tests among ten female students who kept diaries for seven days with three events per day, when tested four months later. The participants were equally confident about their accuracy, even when wrong.
5. The qualitative approach to studying memory tends to focus on memory in the holistic sense, and see it in a social context as a joint process (Asimakopoulou et al 2002).

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